NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
RESEARCH AND TECHNOLOGY RESUME

TITLE

The Reduction and Analysis of Photometric Data on Comet Halley

PERFORMING ORGANIZATION

Kitt Peak National Observatory
950 N. Cherry Avenue
Tucson, AZ 85719

INVESTIGATOR'S NAME

Michael J. S. Belton (with U. Fink, P. Wehinger, H. Spinrad, K. Meech other observers)

DESCRIPTION *(a. Brief statement on strategy of investigation; b. Progress and accomplishments of prior year; c. What will be accomplished this year, as well as how and why; and d. Summary bibliography)*

(a) Strategy: The discovery that periodic variations in the brightness of Comet Halley were characterized by two unrelated frequencies implies that the nucleus is in a complex state of rotation. It either nutates as a result of the random addition of small torque perturbations accumulated over many perihelion passages, or the jet activity torques are so strong that it precesses wildly at each perihelion passage. To diagnose the state of nuclear rotation we have begun a program to acquire photometric time series of the comet as it recedes from the sun. The intention is to observe the decay of the comet's atmosphere and then, when it is unemcumbered by the light of the coma, follow the light variation of the nucleus itself. The latter will be compared with preperihelion time series and the orientation of the nucleus at the time of Vega and Giotto flybys and an accurate rotational ephemeris constructed.

(b) Accomplishments: We have observed Halley on 38 nights during 1987 and approximately 21 nights in 1988. The comet moved from 5 AU to 8.5 AU during this time. The brightness of the coma was found to rapidly decrease in 1988 as the coma and cometary activity collapses. The magnitude in April 1988 was 19 mag (visual) and it is predicted that the nucleus itself will be the major contributor to the brightness in the 1988/89 season. The 1987 data from KPNO is reduced, and that from the Catalina observatory is about half completed. The detailed reduction of 1988 data is expected to begin at the end of June 1988.

(c) Anticipated Accomplishments: We are in the middle of the data reduction process for the present data set of some 410 CCD frames and expect to have this phase completed by the end of 1988 (we are continuing observations and expect to stimulate a Halley Nucleus Observing campaign on an international level for the 1988/89 season, so new data should be forthcoming, which will also require reduction). The future analysis depends on the availability of some basic tools which we are developing now. One is the application of the CLEAN algorithm (for spectral analysis of the time series data), and the other is a program that simulates the light variations of a model Halley's nucleus. The latter is essentially complete, and work is ongoing regarding the CLEAN program.